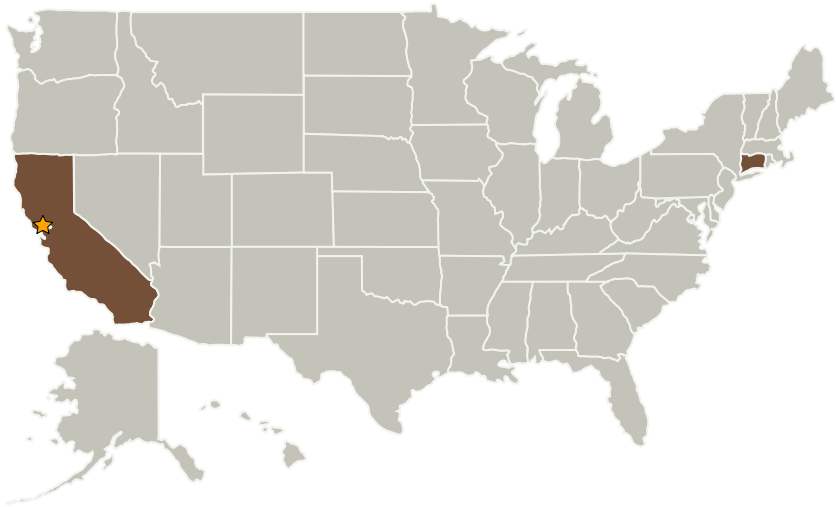
3D Warping Actuation Driven Dynamic Camber Control Concept for Helicopter Rotor Blades, Phase I

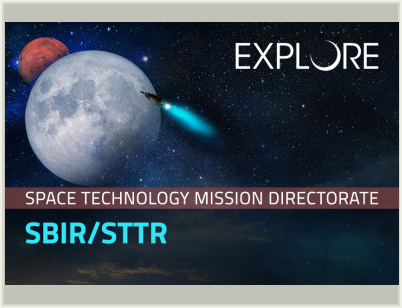
Completed Technology Project (2008 - 2008)

Project Introduction

In a rotorcraft, optimized camber change not only reduces vibratory hub loads and noise but also increases available thrust and improved flight control augmentation. Therefore, the ability to dynamically change airfoil camber is a significant technology advancement leading to improved overall rotorcraft performance. Research efforts in recent years have led to the application of active material actuation for rotorcraft blades in order to dynamically change blade camber. Small-scale bench top system validations have been successful. However, when scaled-up to full-scale aircraft, the performance of current actuation systems in a demanding rotor blade environment gets significantly degraded by operational factors including friction, free play, and, aerodynamic and inertial loads. We propose a unique three dimensional concept wherein the typically closed section blade is cut open to create a torsionally compliant mechanism that acts as its own amplification device; the deformation of the blade is dynamically controlled by out-of-plane warping. Our innovative approach for camber control is a radical departure from the current techniques. The proposed development and engineering effort will lead to a new camber control technology suitable for full-scale aircraft that would result in improved operational efficiencies at lower costs. Concept feasibility will be demonstrated both analytically and through experiments on blade sections of a Sikorsky Blackhawk. A Phase II program will follow for technology scale-up and optimized full blade testing.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Materials Technologies Corporation	Supporting Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Monroe, Connecticut

Primary U.S. Work Locations	
California	Connecticut

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Serkan Ozbay

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.6 Advanced Atmospheric Flight Vehicles